Model 2700 Multimeter/Data Acquisition System

DC CHARACTERISTICS[1]

CONDITIONS: MED (1 PLC)[2] or 10 PLC or MED (1 PLC) with Digital Filter of 10

FUNCTION	RANGE	RESOLUTION	TEST CURRENT ±5% OR BURDEN VOLTAGE	INPUT RESISTANCE OR OPEN CKT. VOLTAGE[3]	ACCURACY: ±(ppm of reading + ppm of range) (ppm = parts per million) e.g., 10ppm = 0.001%) 24 Hour[4] 23°C±1°	90 Day 23°C±5°	1 Year 23°C±5°	TEMPERATURE COEFFICIENT 0°-18°C & 28°-50°C
Voltage[11]	100.0000 mV	0.1 µV		>10 GΩ	15 + 30	25 + 35	30 + 35	(1 + 5)/°C
	1.000000 V	1.0 µV		>10 GΩ	15 + 6	25 + 7	30 + 7	(1 + 1)/°C
	10.0000 V	10 µV		>10 GΩ	10 + 4	20 + 5	30 + 5	(1 + 1)/°C
	100.0000 V	100 µV		>10 MΩ ± 1%	15 + 6	35 + 9	45 + 9	(5 + 1)/°C
	1000.000 V[5]	1 mV		>10 MΩ ± 1%	20 + 6	35 + 9	50 + 9	(5 + 1)/°C
Resistance[6,8]	100.0000 Ω	100 µΩ	1 mA	6.6 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	1.000000 kΩ	1 mΩ	1 mA	6.6 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	10.00000 kΩ	10 mΩ	100 µA	6.6 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	100.0000 kΩ	100 mΩ	10 µA	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	1.000000 MΩ	1.0 Ω	10 µA	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	10.00000 MΩ[7]	10 Ω	0.7 µA // 10MΩ	7.0 V	150 + 6	200 + 10	400 + 10	(95 + 1)/°C
	100.0000 MΩ[7]	100 Ω	0.7 µA // 10MΩ	7.0 V	800 + 30	2000 + 30	2000 + 30	(900 + 1)/°C
Continuity (2W)[21]	1.000 kΩ	100 mΩ	1 mA	6.6 V	40 + 100	100 + 100	100 + 100	(8 + 1)/°C
Current	20.00000 mA	10 nA	<0.2 V		60 + 30	300 + 80	500 + 80	(50 + 5)/°C
	100.0000 mA	100 nA	<0.05 V		100 + 300	300 + 800	500 + 800	(50 + 50)/°C
	1.000000 A	1.0 µA	<0.3 V[9]		200 + 30	500 + 80	800 + 80	(50 + 5)/°C
	3.000000 A	10 µA	<1.0 V[9]		1000 + 15	1200 + 40	1200 + 40	(50 + 5)/°C
Channel (Ratio)[10]	Ratio Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range							
Channel (Average)[10]	Average Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range							

TEMPERATURE[19]

(Display in °C, °F, or K. Exclusive of probe errors.)
Thermocouples (Accuracy based on ITS-90.)

Type	Range	Resolution	90 Day/1 Year (23°C ±5°C) Relative to Simulated Reference Junction	Using 77XX Module	Temperature Coefficient 0°-18°C & 28°-50°C
J	-200 to +760°C	0.001°C	0.2°C	1.0°C	0.03°C/°C
K	-200 to +1372°C	0.001°C	0.2°C	1.0°C	0.03°C/°C
N	-200 to +1300°C	0.001°C	0.2°C	1.0°C	0.03°C/°C
T	-200 to +400°C	0.001°C	0.2°C	1.0°C	0.03°C/°C
E	-200 to +1000°C	0.001°C	0.2°C	1.0°C	0.03°C/°C
R	0 to +1768°C	0.1°C	0.6°C	1.8°C	0.03°C/°C
S	0 to +1768°C	0.1°C	0.6°C	1.8°C	0.03°C/°C
B	+350 to +1820°C	0.1°C	0.6°C	1.8°C	0.03°C/°C
4-Wire RTD: (100Ω platinum [PT100], D100, F100, PT385, PT3916, or user type, Offset compensation On)					
	-200° to 630°C	0.01°C	0.06°C		0.003°C/°C
Thermistor: (2.2kΩ, 5kΩ, and 10kΩ)[20]					
	-80° to 150°C	0.01°C	0.08°C		0.002°C/°C

DC SYSTEM SPEEDS[15,18]

RANGE CHANGES[16]: 50/s (42/s).
FUNCTION CHANGES[16]: 50/s (42/s).
AUTORANGE TIME[16]: <30ms.
ASCII READINGS TO RS-232 (19k BAUD): 55/s.
MAX. INTERNAL TRIGGER RATE: 2000/s.
MAX. EXTERNAL TRIGGER RATE: 375/s.

DC MEASUREMENT SPEEDS[15]

Single Channel, 60Hz (50Hz) Operation

FUNCTION	DIGITS	READINGS/s		PLCs
DCV, DCI, Ohms (<10M), Thermocouple, Thermistor	6.5[12,16]	5	(4)	10
	6.5[16]	30	(24)	1
	6.5[12,16]	50	(40)	1
	5.5[12,16]	100	(80)	0.1
	5.5[16,17]	250	(200)	0.1
	5.5[17]	480	(400)	0.1
	4.5[17]	2000	(1800)	0.01
4W Ohms (<10M)	6.5[16]	1.4	(1.1)	10
	6.5[16]	15	(12)	1
	5.5[17]	33	(25)	0.1
RTD	6.5[16]	0.9	(0.7)	10
	6.5[16]	8	(6.4)	1
	5.5[16,17]	18	(14.4)	0.1
Channel (Ratio), Channel (AVG)	6.5[16]	2.5	(2)	10
	6.5[16]	15	(12)	1
	5.5[17]	25	(20)	0.1

Multiple Channels Into Memory[15,18]

7703 and 7710 Scanning DCV	175/s
7703 and 7710 Scanning with Limits or Time Stamp On	170/s
7703 and 7710 Scanning DCV alternating 2WΩ	40/s
7710 Scanning Temperature (T/C)	80/s
7700 and 7708 Scanning Temperature (T/C)	50/s

Multiple Channels Into and Out of Memory[15,16,17,18]

7703 and 7710 Scanning DCV	150/s
7703 and 7710 Scanning with Limits or Time Stamp On	150/s
7703 and 7710 Scanning DCV alternating 2WΩ	40/s
7710 Scanning Temperature (T/C)	70/s
7702 Scanning DCV	65/s
7700 and 7708 Scanning Temperature (T/C)	50/s

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DC SPEED vs. NOISE REJECTION

Rate	Filter	Readings/s[12]	Digits	RMS Noise 10V Range	NMRR	CMRR[14]
10	50	0.1 (0.08)	6.5	<1.2 µV	110 dB[13]	140 dB
1	Off	15 (12)	6.5	<4 µV	90 dB[13]	140 dB
0.1	Off	500 (400)	5.5	<22 µV	-	80 dB
0.01	Off	2000 (1800)	4.5	<150 µV	-	80 dB

DC MEASUREMENT CHARACTERISTICS

DC Volts

A-D LINEARITY: 1.0 ppm of reading + 2.0 ppm of range.

INPUT IMPEDANCE:

100mV-10V Ranges: Selectable >10GΩ// with <400pF or 10MΩ ±1%.

100V, 1000V Ranges: 10MΩ ±1%.

INPUT BIAS CURRENT: <75pA at 23°C.

COMMON MODE CURRENT: <500nApp at 50Hz or 60Hz.

AUTOZERO ERROR: Add ±(2ppm of range error +5µV) for <10 minutes and ±1°C.

INPUT PROTECTION: 1000V, all ranges, 300V with plug-in modules.

Resistance

MAX 4WΩ LEAD RESISTANCE: 10% of range per lead for 100Ω and 1kΩ ranges; 1kΩ per lead for all other ranges.

OFFSET COMPENSATION: Selectable on 4WΩ 100Ω, 1kΩ, and 10kΩ ranges.

CONTINUITY THRESHOLD: Adjustable 1 to 1000Ω.

INPUT PROTECTION: 1000V, all Source Inputs, 350V Sense Inputs, 300V with plug-in modules.

DC Current

SHUNT RESISTORS: 100mA-3A, 0.1Ω. 20mA, 5Ω.

INPUT PROTECTION: 3A, 250V fuse.

Thermocouples

CONVERSION: ITS-90.

REFERENCE JUNCTION: Internal, External, or Simulated (Fixed).

OPEN CIRCUIT CHECK: Selectable per channel. Open >11.4k ±200Ω.

EARTH ISOLATION: 500V peak, >10GΩ and <150pF any terminal to chassis.

DC Notes

1. 20% overrange except on 1000V and 3A.
2. Add the following to "ppm of range" uncertainty; 100mV 15ppm, 1V and 100V 2ppm, 100Ω 30ppm, 1K→1MΩ 2ppm, 10mA and 1A 10ppm, 100mA 40ppm.
3. ±2% (measured with 10MΩ input resistance DMM, >10GΩ DMM on 10MΩ and 100MΩ ranges).
4. Relative to calibration accuracy.
5. For signal levels >500V, add 0.02ppm/V uncertainty for portion exceeding 500V.
6. Specifications are for 4-wire Ω, 100Ω with offset compensation on, 77xx plug-in module with LSYNC and offset compensation on. With offset compensation on OPEN CKT. VOLTAGE is 12.8V. For 2-wire Ω add 1Ω additional uncertainty.
7. Must have 10% matching of lead resistance in Input HI and LO.
8. Add the following to "ppm of reading" uncertainty when using plug in modules:

	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
All Modules:				220 ppm	2200 ppm
7701, 7703, 7707, and 7709 Modules:	10 ppm	100 ppm	1000 ppm	1%	10%
7706, 7708 Modules:	5 ppm	50 ppm	500 ppm	5000 ppm	5%
7710 Model 23°C ±5°C:	11 ppm	110 ppm	1100 ppm	1.1%	11%
7710 Model Temp Coeff. >28°→50°C	0.3 ppm/°C	3 ppm/°C	30 ppm/°C	0.03%/°C	0.3%/°C

9. Add 1V when used with plug-in modules.
10. For RATIO, DCV only. For AVERAGE, DCV, and Thermocouples only. Available with plug-in modules only.
11. Add 6µV to "of range" uncertainty when using Models 7701, 7703, and 7707, 3µV for Models 7706, 7709, and 7710.
12. Auto zero off.
13. For LSYNC On, line frequency ±0.1%. For LSYNC Off, use 60dB for ≥ 1PLC.
14. For 1kΩ unbalance in LO lead. AC CMRR is 70dB.
15. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay = 0.
16. Speeds include measurements and binary data transfer out the GPIB.
17. Sample count = 1000 (into memory buffer), auto zero off.
18. Auto zero off, NPLC = 0.01.
19. Additional Uncertainty

Type	Range	7710 Module Using CJC
J	0 to +760°C	1.5°C
K	0 to +1372°C	—
N	0 to +1300°C	0.5°C
T	0 to +400°C	0.5°C
E	0 to +1000°C	0.5°C
R	+400 to +1768°C	0.9°C
S	+400 to +1768°C	0.9°C
B	+1100 to +1820°C	0.9°C

			Plug-In Modules				
Type	Range	Front Terminals Sim. Ref. Junction	7709 Sim. Ref. Junction	7701, 7703, 7707 Sim. Ref. Junction	7700 and 7708 Using CJC	7706 Using CJC	7710 Using CJC
J	-200 to 0°C	0.1	0.1	0.3	0.8	1.6	4.5
K	-200 to 0°C	0.2	0.2	0.4	0.8	1.6	1
N	-200 to 0°C	0.3	0.3	0.6	0.8	1.6	2.5
T	-200 to 0°C	0.2	0.1	0.4	0.8	1.6	2.5
E	-200 to 0°C	-	0.1	0.3	0.8	1.6	2.5
R	0 to +400°C	0.4	0.6	1.2	0.5	1.0	2.2
S	0 to +400°C	0.4	0.6	1.2	0.5	1.0	2.2
B	+350 to +1100°C	0.8	0.3	1.7	0.5	1.0	2.2

20. For lead resistance >0Ω, add the following uncertainty/Ω for measurement temperatures of:

		70°–100°C	100°–150°C
2.2 kΩ	(44004)	0.22°C	1.11°C
5.0 kΩ	(44007)	0.10°C	0.46°C
10 kΩ	(44006)	0.04°C	0.19°C

21. Front panel resolution limited to 0.1Ω.

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AC SPECIFICATIONS[1]

Function	Range	Resolution	Calibration Cycle	Accuracy: ±(% of reading + % of range), 23°C ±5°C 3 Hz-10 Hz[13]	10 Hz-20 kHz	20 kHz-50 kHz	50 kHz-100 kHz	100 kHz-300 kHz
Voltage[2]	100.0000 mV	0.1 µV	90 Days	0.35 + 0.03	0.05 + 0.03	0.11 + 0.05	0.6 + 0.08	4.0 + 0.5
	1.000000 V	1.0 µV	(all ranges)					
	10.00000 V	10 µV	1 Year	0.35 + 0.03	0.06 + 0.03	0.12 + 0.05	0.6 + 0.08	4.0 + 0.5
	100.0000 V	100 µV	(all ranges)					
	750.000 V	1.0 mV						
			(Temp. Coeff.)/°C[3]	0.035 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01
				3 Hz-10 Hz	**10 Hz-3 kHz**	**3 kHz-5kHz**		
Current[2]	1.000000 A	1.0 µA	90 Day/1 Yr.	0.30 + 0.04	0.10 + 0.04	0.14 + 0.04		
	3.00000[14] A	10 µA		0.35 + 0.06	0.15 + 0.06	0.18 + 0.06		
			(Temp. Coeff.)/°C[3]	0.035 + 0.006	0.015 + 0.006	0.015 + 0.006		
				Accuracy ±(ppm of reading + offset ppm) (3 Hz-500 kHz) (333 ms-2 µs)				
Frequency[4] **and Period**	100 mV	0.333 ppm	90 Day/1 Yr.	80 ppm + 0.333 ppm (SLOW, 1s gate)				
	to	3.33 ppm		80 ppm + 3.33 ppm (MED, 100ms gate)				
	750 V	33.3 ppm		80 ppm + 33.3 ppm (FAST, 10ms gate)				

Additional Uncertainty ±(% of reading)

Low Frequency Uncertainty	MED	FAST
20Hz - 30Hz	0.3	—
30Hz - 50Hz	0	—
50Hz - 100Hz	0	1.0
100Hz - 200Hz	0	0.18
200Hz - 300Hz	0	0.10
> 300Hz	0	0

CREST FACTOR[5]:	1–2	2–3	3–4
Additional Uncertainty:	0.05	0.15	0.30

Maximum Crest Factor: 5 at full-scale.

AC MEASUREMENT CHARACTERISTICS

AC Volts

MEASUREMENT METHOD: AC-coupled, True RMS.

INPUT IMPEDANCE: 1MΩ ±2% // by <100pF.

INPUT PROTECTION: 1000Vp or 400VDC, 300Vrms with plug-in modules.

AC Current

MEASUREMENT METHOD: AC-coupled, True RMS.

SHUNT RESISTANCE: 0.1Ω.

BURDEN VOLTAGE: 1A <0.3Vrms, 3A <1Vrms. Add 1Vrms when used with plug-in modules.

INPUT PROTECTION: 3A, 250V fuse.

Frequency and Period

MEASUREMENT METHOD: Reciprocal Counting technique.

GATE TIME: SLOW 1s, MED 100ms, and FAST 10ms.

AC General

AC CMRR[6]: 70dB.

VOLT HERTZ PRODUCT[15]: $\leq 8 \times 10^7$ Volt-Hz.

AC MEASUREMENT SPEEDS[7,8]

Single Channel, 60Hz (50Hz) Operation

Function	Digits	Readings/s	Rate	Bandwidth
ACV, ACI	6.5	2s/Reading	SLOW	3 Hz-300kHz
	6.5	4.8 (4)	MED	30 Hz-300kHz
	6.5[9]	35 (28)	FAST	300 Hz-300kHz
Frequency, Period	6.5	1 (1)	SLOW	3 Hz-300kHz
	5.5	9 (9)	MED	30 Hz-300kHz
	4.5	35 (35)	FAST	300 Hz-300kHz
	4.5[10]	65 (65)	FAST	300 Hz-300kHz

Multiple Channel Into Memory[10,11]

7710 SCANNING ACV: 120/s.

7710 Scanning ACV with Auto Delay on: 2s/reading.

AC System Speeds[7,9,11]

RANGE CHANGES[12]: 4/s (3/s).

FUNCTION CHANGES[12]: 4/s (3/s).

AUTORANGE TIME: < 3s.

ASCII READINGS TO RS-232 (19.2k baud): 50/s.

MAX. INTERNAL TRIGGER RATE: 300/s.

MAX. EXTERNAL TRIGGER RATE: 250/s.

AC Notes

1. 20% overrange except on 750V and 3A.
2. Specifications are for SLOW mode and sine wave inputs >5% of range. SLOW and MED are multi-sample A/D conversions. FAST is DETector:BANDwidth 300 with nPLC = 1.0.
3. Applies to 0°–18°C and 28°–50°C.
4. Specifications are for square wave inputs only. Input signal must be >10% of ACV range. If input is <20mV on the 100mV range then the frequency must be >10Hz. For sinewave inputs, frequency must be >100Hz.
5. Applies to non-sine waves >5Hz and <500Hz. (Guaranteed by design for Crest Factors >4.3)
6. For 1kΩ unbalance in LO lead.
7. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay=0.
8. Includes measurement and binary data transfer out GPIB (reading element only).
9. Auto Zero off.
10. Sample count = 1000 (into memory buffer).
11. DETector:BANDwidth 300 with nPLC = 0.01.
12. Maximum useful limit with trigger delay = 175ms.
13. Typical uncertainties. Typical represents two sigma or 95% of manufactured units measure < 0.35% of reading and three sigma or 99.7% < 1.06% of reading.
14. For signal levels >2.2A, add additional 0.4% to "of reading" uncertainty.
15. 750Vac range limited to 707Vrms and 85kHz (sinewave input) or or 8×10^7 Volt-Hz.

Model 2700 Multimeter/Data Acquisition System

GENERAL SPECIFICATIONS

EXPANSION SLOTS: 2

POWER SUPPLY: 100V / 120V / 220V / 240V.

LINE FREQUENCY: 50Hz to 60Hz and 400Hz, automatically sensed at power-up.

POWER CONSUMPTION: 28VA.

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 80% RH at 35°C. Altitude up to 2000 meters.

STORAGE ENVIRONMENT: -40°C to 70°C.

BATTERY: Lithium battery-backed memory, 3 years @ 23°C.

EMC: Conforms to European Union Directive 89/336/EEC EN61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC EN61010-1, CAT I.

VIBRATION: MIL-PRF-28800F Class 3, Random.

WARM-UP: 2 hours to rated accuracy.

DIMENSIONS:

Rack Mounting: 89mm high × 213mm wide × 370mm deep (3.5 in. × 8.375 in. × 14.563 in.).

Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4.125 in. × 9.375 in. × 14.563 in.).

SHIPPING WEIGHT: 6.5kg (14 lbs).

DIGITAL I/O: 2 inputs, 1 for triggering and 1 for hardware interlock. 5 outputs, 4 for Reading Limits and 1 for Master Limit. Outputs are TTL compatible or can sink 250mA, diode clamped to 33V.

TRIGGERING AND MEMORY:

Window Filter Sensitivity: 0.01%, 0.1%, 1%, 10%, or Full-scale of range (none).

Reading Hold Sensitivity: 0.01%, 0.1%, 1%, or 10% of reading.

Trigger Delay: 0 to 99 hrs (1ms step size).

External Trigger Delay: <2ms.

External Trigger Jitter: <1ms.

Memory Size: 55,000 readings.

MATH FUNCTIONS: Rel, Min/Max/Average/Std Dev/Peak-to-Peak (of stored reading), Limit Test, %, 1/x and mX + b and with user defined units displayed.

REMOTE INTERFACE:

GPIB (IEEE-488.2) and RS-232C.

SCPI (Standard Commands for Programmable Instruments)

ACCESSORIES SUPPLIED: Model 1751 Safety Test Leads, Product Information CD-ROM, Software CD-ROM with IVI/VISA drivers for VB, VC/C++, LabVIEW, TestPoint, and LabWindows/CVI, and free runtime startup softare.

ACCESSORIES AVAILABLE:

77xx Modules
Extended Warranty
ExceLINX-1A (Excel add-in datalogger software)
TestPoint™ Software Development Package

SOFTWARE: Windows 98, NT, 2000, ME, and XP compatible.